2011

Final Report: Section 4. Engineering Demonstration Projects

Horsley Witten Group, Inc.

SECTION 4

ENGINEERING DEMONSTRATION PROJECTS

1.0 INTRODUCTION

As a means to demonstrate the innovative BMP to 'keep water local', improve habitat and restore the natural water balance, HW worked with the Steering Committee to select six projects to develop into demonstration design projects. Demonstration projects were included in Phase II as a means of putting real-life examples of the recommended techniques out into the watershed, with the expectation that this will jump-start their implementation throughout the watershed. Demonstration projects are valuable tools for educating a wide audience about the realities of implementing new and innovative engineering design techniques.

Often times, the biggest initial hurdle to implementing new technology is a fear of the unknown; it is much easier to go with traditional familiar design techniques, even sometimes when they have been proven to be inadequate or inefficient. By facilitating these demonstration designs, the Taunton Watershed Management Plan is helping project partners to overcome that hurdle. Once people see how these techniques really look and function when they are constructed, they will be easier to implement on a broader scale. When a demonstration project is selected and designed, the partner organization has the opportunity to learn from the process; there are decisions to be made about location, size and extent of the project, and the ability to commit to various levels of ongoing maintenance of the project. Since many of the project partners also contributed in-kind resources toward necessary field investigations, in terms of field reconnaissance, test pit equipment, and observation, the partners also learned a little more about their own sites and the type of baseline information required for designing the demonstration projects.

Phase I of the Taunton River Watershed Management Plan recommended that stormwater and wastewater techniques be implemented to 'keep water local' and promote LID design. It also recommended improvements to the protection and restoration of stream buffers since these are extremely important habitat areas for sensitive species and also provide important protection of water quality in the streams. Therefore, the six demonstration projects were designed to demonstrate LID stormwater techniques, onsite wastewater treatment and disposal, and buffer restoration to promote on-site infiltration, improve water quality and restore buffer habitat.

The locations of these demonstration projects were also intentionally selected so that they would be accessible to a variety of audiences, ranging from corporate citizens to recreational groups and educational facilities. Once these projects are brought to construction as part of Phase III of the watershed planning process, we recommend that these projects are monitored and that onsite educational signs and educational brochures about these facilities are developed to make them more accessible and understandable to both casual observers and interested researchers.

1.1. Selection Process

The process to identify and select these six projects lasted approximately six months, and the field work and design for the projects lasted another six to nine months. HW reached out to various communities and organizations in the watershed, as well as to our Steering Committee and attendees at our various public educational meetings, to help us identify candidate projects and willing partners.

The final set of projects was selected from an initial list of more than 40 potential projects based on selection criteria consisting of location within impacted subwatersheds, coverage throughout the Taunton River watershed, variety among types of practices being demonstrated, willingness of the partner to participate and support the project, and likelihood that the project will ultimately go to construction. Ideally, project locations and solutions would be selected primarily based upon their hydrologic, water quality, and habitat benefits within impacted subwatersheds, as identified in the Taunton River Watershed Management Plan Phase I Final Report (2008). For example; subwatersheds with significant water balance deficits would be targeted primarily for a number of large infiltration retrofit projects, and subwatersheds with heavily impacted stream buffer areas and large proportions of related priority habitat area would be targeted for habitat restoration projects. However, given that this phase of the Taunton River Watershed Management Plan involves only demonstration projects, the other considerations identified above were at least as important, if not more so, to the site selection process in this initial demonstration phase of project implementation.

The scope of work for this project was prescribed to produce 75 % complete engineering design plans, with the project partners being responsible for any further work to bring the projects through permitting, final design, and construction. However, the goal of this work is to lead to the future construction of these demonstration projects so a wide audience can benefit from observing and learning from the best management practices.

The final six demonstration projects are described below in more detail. A summary of the projects as they relate to their host sub-watershed is provided in Table 4.1 below. These data are drawn from the Phase I report analyses. A map showing the locations of each demonstration project is presented in Figure 4.1 below. In addition, the 75% engineering design plans, construction cost estimates, additional photos, and field data developed through this project are presented in the Appendices.

Figure 4.1. Locations of Demonstration Projects

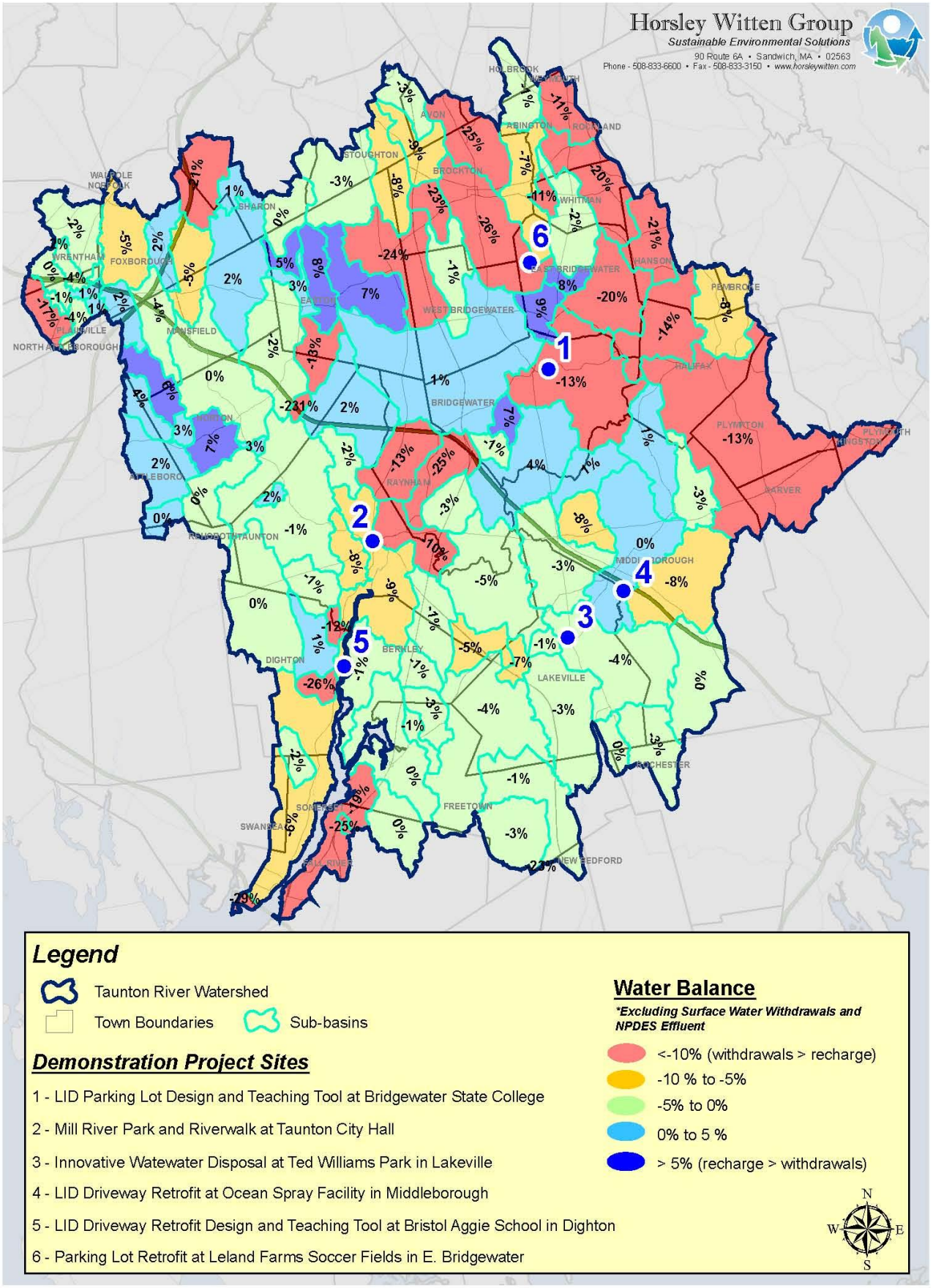


TABLE 4.1. Summary of Sub-Watershed Context for the 6 Selected Demonstration Projects

Site ID	Project Type			Water Balance (%)* within Subwatershed		Habitat Protection* within Subwatershed			Subwatershed ID Number*	Resource Watershed*	City/Town	Site Description
	Stormwater	*Habitat Restoration/ Improvement*	*Waste-water*	*w/ NPDES surface water discharges and surface water withdrawals*	*w/out NPDES surface water discharges and surface water withdrawals*	*Impervious cover w/in 200' stream buffer*	*% TNC Priority Habitat unprotected*	*w/in TNC Priority Habitat*				
1	X			-11	-13	0-5	60-70	no	25054	Upper Taunton	Bridgewater	Design of LID parking lot to service new science building under construction at Bridgewater State College.
2	X	X		259	-9	10-15	70-80	Tier 1 Riparian	25120	Lower Taunton	Taunton	Mill River Park and Riverwalk. LID and buffer restoration site at degraded parking lot behind City Hall and Police Station.
3			X	-4	-4	0-5	20-30	Tier 2	25068	Nemasket River	Lakeville	Alternative onsite wastewater disposal for proposed new commissary building at Ted Williams Park, adjacent to Loon Pond.
4	X	X		14	0	0-5	70-80	Adjacent to Tier 1 Riparian and Tier 2	25075	Nemasket River	Middleborough	LID stormwater retrofit at entranceway to Ocean Spray processing plant.
5	X	X		36	-6	0-5	60-70	Tier 2	25197	Lower Taunton	Dighton	Bioretention systems and swales to treat stormwater runoff from existing parking area and drive aisle at Bristol County Agricultural High School.
6	X			204	-26	15-20	No PH	No	25011	Matfield River	East Bridgewater	Constructed wetland and LID stormwater management at informal parking area for Leland Farms/Belmont Street soccer faiclity.

* Reference Phase I Report for Subwatershed Analyses.

2.0 LID PARKING LOT DESIGN AND TEACHING TOOL AT BRIDGEWATER STATE UNIVERSITY, BRIDGEWATER

2.1 Overview

Bridgewater State University (BSU) was in the process of finalizing designs for a major capital construction project to renovate and expand the Conant Science and Math Building when we began our search for demonstration projects. Following discussions with the school and their architects and engineers for the science facility project, we were guided toward designing an innovative LID parking lot behind the new facility, to be constructed under a subsequent phase of the project. The school was interested in participating in the project, and was reasonably confident that the project would be constructed in the near future, given that the parking lot was necessary to serve the new science facility. There are clear benefits associated with the location of this project at a University campus; the facility can be used easily as a teaching tool within the science curriculum at the school, and the concept of LID at the site is well aligned with the architecture of the science facility itself, which aims to be LEED silver certified.

2.2 Data Collection and Design Process

A preliminary concept design was developed by the school's engineer for the science building project as a placeholder, and HW used this design and the available engineering survey data as a starting point for our design. HW coordinated a kickoff meeting with the architect/engineer team for the Conant Science Building Team including, Payette Associates and Nitsch Engineering, as well as BSU science faculty. Subsequently, we worked under the guidance of Karen Jason, BSU Associate Vice President for Facilities Management and Planning, throughout the project. HW performed two site visits and meetings with Karen Jason to observe and confirm existing conditions and to discuss interim draft concepts.

2.3 Description of Design

The project was to design an LID parking lot that could be used as a teaching tool within the science curriculum at BSU. The existing conditions at the site include a large paved parking area that has been disturbed to allow access and storage for the construction at the Conant Science and Math Building. The parking lot was in need of realignment and redesign as a result of the Science facility construction but the design and construction of the lot was planned to occur in a subsequent project phase. Under existing conditions, the students and those who parked in the lot were directed to follow a walking path diagonally across the parking lot delineated only by painted lines in the pavement, creating a hazard for both pedestrians and cars within a sea of uninterrupted impervious cover.

The new parking lot was designed to minimize impervious cover while working around the new footprint of the Conant Science facility. It includes impervious cover reduction and vegetated bioretention areas within the long islands between drive aisles, as well as underground recharge chambers to infiltrate runoff into the ground to the maximum extent practicable. The original conceptual design for the parking lot was revised so that the drive aisles would be located perpendicular to the direction of runoff, to maximize the ability to capture that runoff in the

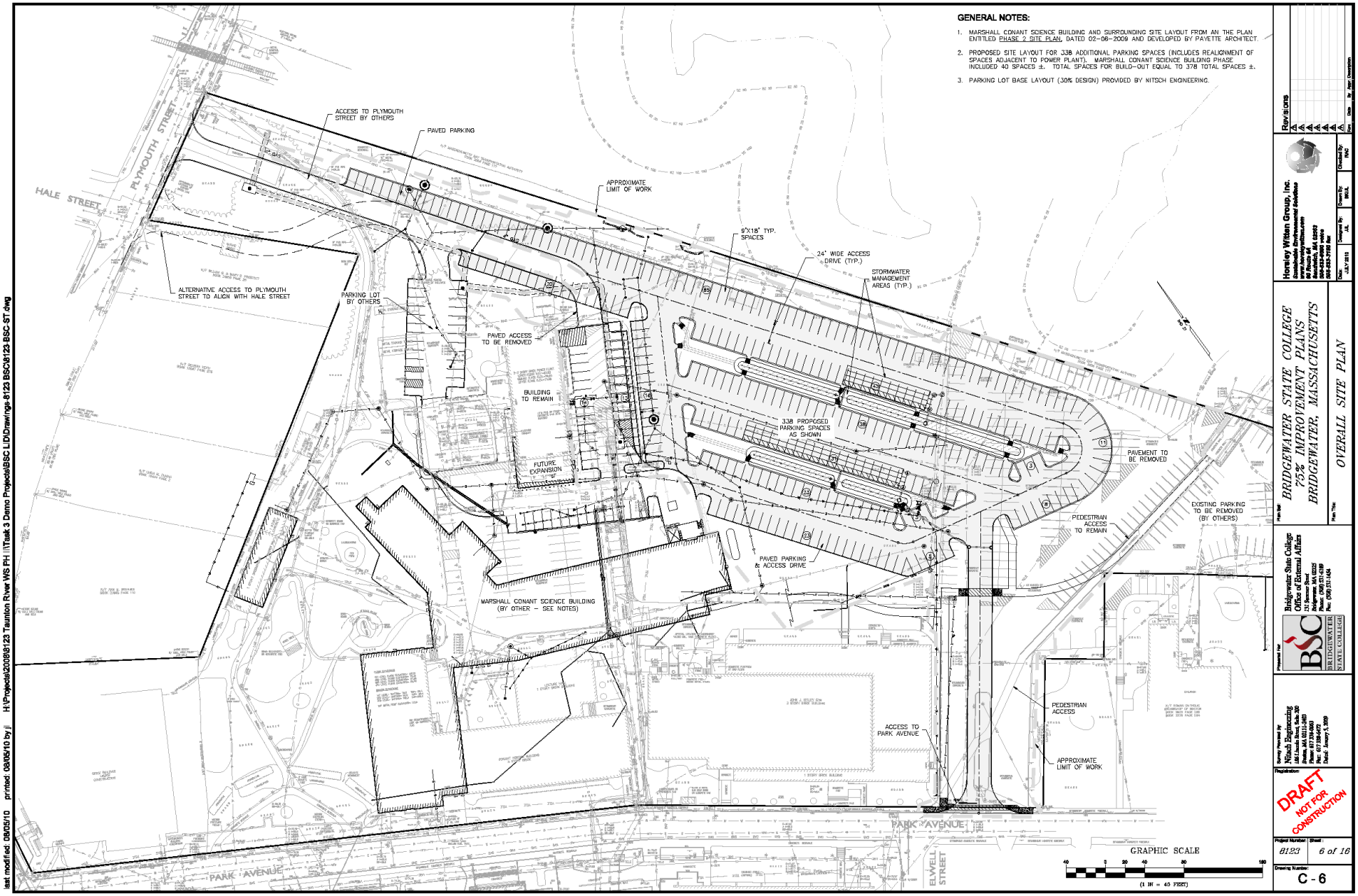
vegetated bioretention systems. The proposed drainage systems will convey runoff from the parking areas, access drives, and sidewalks by means of a series of catch basins, manholes, drain pipes, and grass channels before collecting in bioretention treatment areas and an underground recharge chamber system. The proposed limit of disturbance is approximately 5.5 acres.

The system forms a treatment train that will meet the MA Stormwater Standards for redevelopment and will provide water quality treatment, peak flow attenuation, and infiltration. The design will treat the pollutants from the first 1-inch of runoff from the parking lot and will reduce peak flows from the site for a range of design storms from the 1-year to the 100-year 24-hour storm event. In addition, the system was designed to recharge the annual volume expected to recharge at the site under pre-development conditions (i.e., natural conditions). Due to poor soils at the site (Hydrologic Soil Group C) substantial recharge would not be expected to occur under natural conditions, thus the proposed recharge is designed accordingly. The proposed stormwater design mimics natural processes by directing runoff to vegetated channels, bioretention systems, and underground recharge chambers.

The site plan for the LID parking lot, designed to a 75% engineering design level, is presented in Figure 4.2. The full plan set is presented in the Appendices, along with a planning level cost estimate.

Existing Conditions: Bridgewater State University Parking Lot

Figure 4.2. 75% Design Plan for Bridgewater State University Parking Lot



3.0 MILL RIVER PARK AND RIVER WALK AT CITY HALL, TAUNTON

3.1 Overview

A large public parking lot behind Taunton City Hall drains to the Mill River just upstream of its confluence with the Taunton River, carrying of sediments and other pollutants directly into and causing erosion along the banks of the river. This site, together with a riverside walking path within the Boyden Refuge owned by the City of Taunton, was brought to our attention by both the project Steering Committee and members of the Taunton River Watershed Alliance. HW visited both sites and contacted the City Conservation Commission with a formal letter asking for their cooperation in undertaking a demonstration at either location to improve the erosion within the stream buffer and to improve the stormwater management at the sites. These letters are included in Appendix D. The Conservation Commission formally voted to support projects at both locations.

Subsequently, we learned of a parallel effort to explore the redevelopment of the City Hall parking lot site along the Mill River into a city Park, potentially with money from the Gateway City Parks Program. With help from the City and the Steering Committee, we initiated a collaborative effort to develop a demonstration project to combine a city park with LID stormwater improvements to treat stormwater from the upgradient parking area and restore the river buffer within the project limits. The project Steering Committee then voted to include this as one of the six demonstration projects.

3.2 Data Collection and Design Process

We completed our 75% design plans in July in conjunction with the landscape architecture firm Brown, Richardson & Rowe (BRR), who was contracted by the MA Executive Office of Energy and Environmental Affairs under the Gateway City Parks Program. Together, HW and BRR developed a design to redevelop a portion of severely degraded parking lot into a park directly adjacent to the Mill River behind Taunton City Hall and the Police Station. HW's work included a wetland delineation and topographic survey as well as extensive interaction with local officials, as described above. HW subcontracted to BRR to provide final design, bid support, and construction inspection services related to the LID stormwater management design and buffer restoration portions of the site design, with additional funding provided by the Gateway City Parks Program. The project received an Order of Conditions from the Conservation Commission in September 2010, and is currently proceeding through the local permitting process with the Taunton Historic District Commission. The Gateway City Parks Program has also provided construction funds to the City of Taunton and construction is anticipated to begin in 2011.

3.3 Description of Design

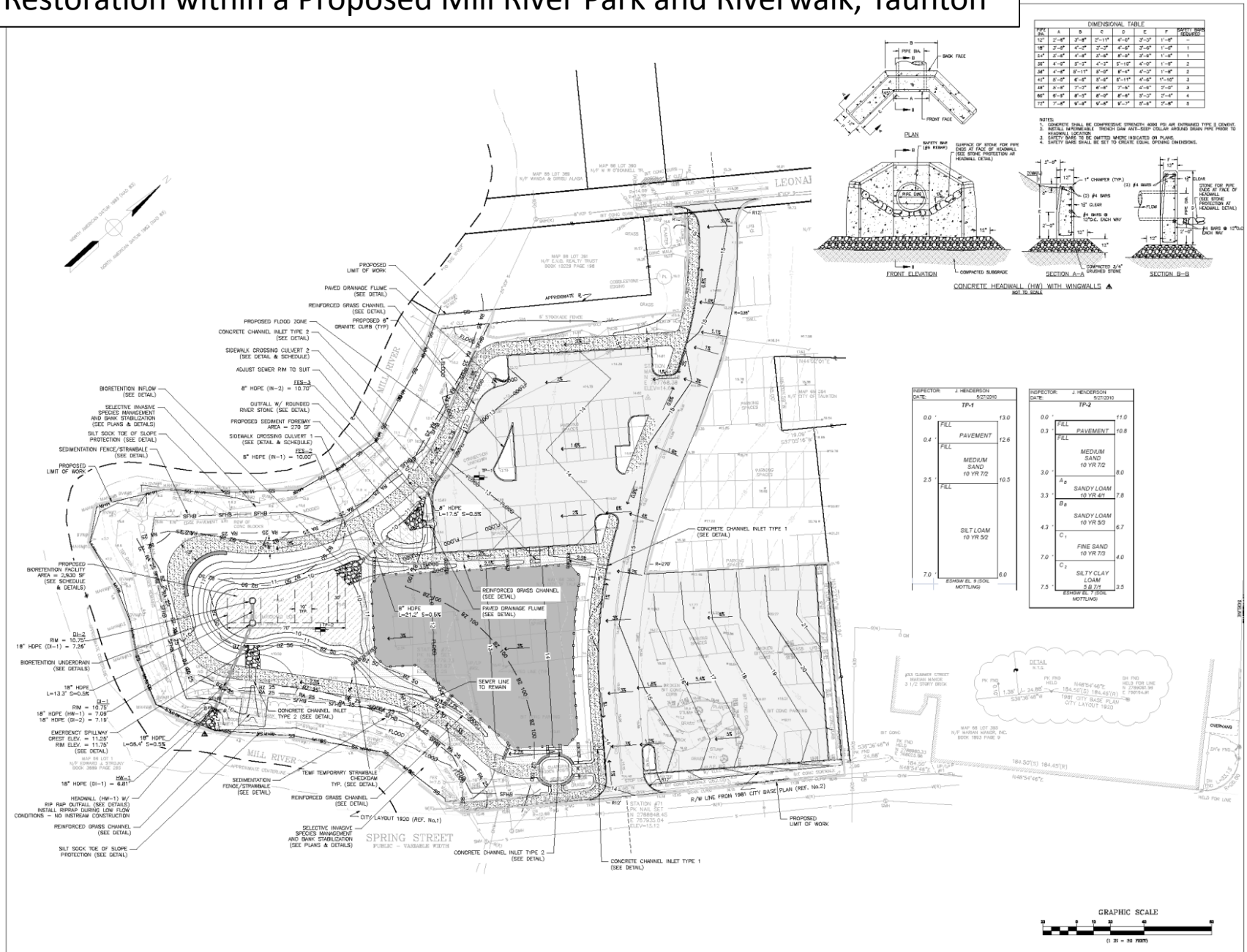
HW's design included LID stormwater management techniques and restoration of a vegetated buffer adjacent to the river, while BRR's design included a riverwalk, improved sidewalk, and enhanced parking areas as well as a green space that may become a local skate park pending future funds. HW participated in two public meetings in Taunton related to the park, as part of BRRs efforts to gather feedback about the park, as well as several meetings prior to that with the

Mayor, Conservation Agent, Parks Commissioner, Skateboard Committee, and other local interested parties to discuss the potential project and gain support and feedback. The LID techniques incorporated in the design include water quality swales and a sediment forebay leading to a bioretention system that subsequently discharges into the Mill River. The plan also results in a reduction of overall impervious cover at the site, increased vegetation, increased width of the vegetated buffer and an invasive species management plan for Japanese knotweed, Oriental bittersweet, sycamore maple, and tree-of-heaven.

A site plan and rendering are presented in Figures 4.3 and 4.4 below. A full plan set for the 75% engineering design and a planning level cost estimate are provided in the Appendices.

Existing Conditions: Mill River Park and Riverwalk, Taunton

Figure 4.3. 75% Design Plan for LID Parking Lot Design and Buffer Restoration within a Proposed Mill River Park and Riverwalk, Taunton



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Mill River Park and Riverwalk

Taunton, MA

KEY PLAN:

REVISIONS:

No.	Revision	Date
1	Revised Flume Outlet	10/07/10

STAMPED AND SIGNED:

PERMITTING PLANS
08-25-2010

DRAWING TITLE:

GRADING AND DRAINAGE PLAN

DESIGNED: KMH

DRAWN: KMH CHECKED: RAC

DATE: 08-28-10

SCALE: 1"=20'-0"

SUBMISSION: PERMITTING PLANS

DRAWING NO:

C – 3

Figure 4.4. Rendering of Proposed LID Parking Lot Design and Buffer Restoration Within a Proposed Mill River Park an Riverwalk, Taunton

Brown, Richardson & Rowe, Inc.
Landscape Architects and Planners
3 Post Office Square
Boston, MA 02110

Horsley Witten Group
Sustainable Environmental Solutions
www.horsleywitten.com

MILL RIVER PARK
Taunton, Massachusetts

FUTURE PROGRAM AND DESIGN PLAN

Gateway Cities Parks Program
Executive Office of Energy & Environmental Affairs

COMMUNITY MEETING #2
June 23, 2010

4.0 INNOVATIVE WASTEWATER DISPOSAL AT TED WILLIAMS PARK, LAKEVILLE

4.1 Overview

HW completed a 75% design for an on-site wastewater system and drip irrigation disposal systems for a soon-to-be renovated Commissary Building at the Ted Williams Park ball field complex. The current system is undersized and out of compliance. This drip irrigation wastewater disposal system was selected because it allows disposal of the treated effluent within the top 8-12 inches of the soil horizon so that it can meet the MA State Environmental Code Title 5 requirements for depth to seasonal high groundwater. For this particular site, HW specified the Perc-Rite Drip Dispersal System, which is a MA DEP approved innovative/alternative wastewater technology. HW coordinated with the manufacturer of the Perc-Rite Drip Dispersal System to confirm that the specified system can also be used under athletic fields or other open areas that will not be significantly impacted, nor will it impact the field playing conditions, making it appropriate for use in the outfields of the baseball facility, if needed.

4.2 Data Collection and Design Process

In developing this design, we worked with the Town Health agent, the Parks Commission Chairman, and a Selectman to obtain an understanding of existing conditions and future uses of the building in order to estimate flows. We performed a site survey and test pits, as well as two sets of percolation tests using a double ring infiltrometer for the purposes of estimating infiltration capacity at various soil depths. The Town of Lakeville provided a backhoe and operator for the test pits.

4.3 Description of Design

The wastewater treatment system is being sized to service the soon-to-be upgraded Commissary Building, a 200-seat function facility. The design flow for the project is 3,000 gallons per day (gpd) based on a 200-seat function facility at 15 gallons per day (gpd) per seat (per Title 5).

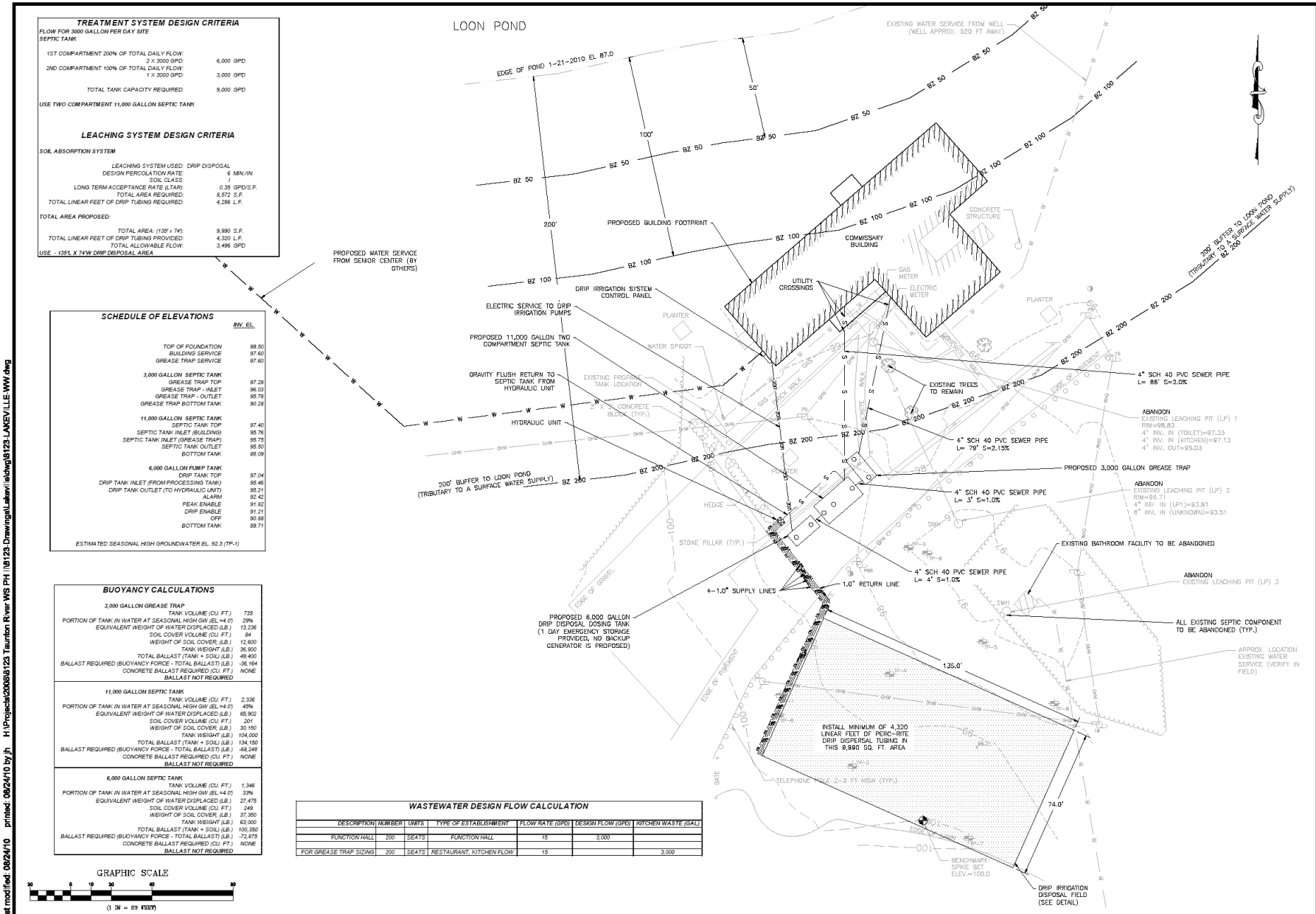
The system is comprised of a 3,000 gallon grease trap sized based on 15 gpd/seat, an 11,000 gallon two compartment septic tank sized to accommodate 200% and 100% of the design flow, a 6,000 gallon drip disposal dosing tank sized for 100% emergency capacity, a drip irrigation hydraulic unit, four supply forcemains, one return forcemain, and a four zone drip irrigation leaching system. Duplex alternating pumps will dose the drip irrigation field. The drip irrigation tubing will be installed approximately 1-foot below grade with minimal disturbance to the existing grass field. Discussions with the manufacturer indicate that most sporting activities, such as baseball and soccer, that do not involve significant tearing of the grass from cleats are suitable for the fields above the drip irrigation system.

No variances to the local health code would be needed for this system. The drip irrigation disposal system is proposed to meet the required five-foot separation to seasonal high groundwater required by Massachusetts Title 5 without the installation of a mounded system or a variance from depth of groundwater.

A site plan and rendering are presented in Figures 4.5 and 4.6 below. A full plan set for the 75% engineering design, along with a planning level cost estimate, observation hole and percolation test logs and application for Disposal System Construction Permit are provided in the Appendices.

Existing Conditions: On-Site Wastewater Treatment and Drip Irrigation Disposal System at Ted Williams Park Commissary Building, Lakeville

Figure 4.5. 75% Design Plan for On-Site Wastewater Treatment and Drip Irrigation Disposal System at Ted Williams Park Commissary Building, Lakeville



TREATMENT SYSTEM DESIGN CRITERIA

FLOW FOR 3000 GALLON PER DAY SITE
SEPTIC TANK

1ST COMPARTMENT 200% OF TOTAL DAILY FLOW: 2 X 3000 GPD:	6,000 GPD
2ND COMPARTMENT 100% OF TOTAL DAILY FLOW: 1 X 3000 GPD:	3,000 GPD
TOTAL TANK CAPACITY REQUIRED:	9,000 GPD

USE TWO COMPARTMENT 11,000 GALLON SEPTIC TANK

LEACHING SYSTEM DESIGN CRITERIA

SOIL ABSORPTION SYSTEM

LEACHING SYSTEM USED:	DRIP DISPOSAL
DESIGN PERCOLATION RATE:	6 MIN./IN.
SOIL CLASS:	I
LONG TERM ACCEPTANCE RATE (LTAR):	0.35 GPD/S.F.
TOTAL AREA REQUIRED:	8,572 S.F.
TOTAL LINEAR FEET OF DRIP TUBING REQUIRED:	4,286 L.F.
TOTAL AREA PROPOSED:	
TOTAL AREA: (135' x 74'):	9,990 S.F.
TOTAL LINEAR FEET OF DRIP TUBING PROVIDED:	4,320 L.F.
TOTAL ALLOWABLE FLOW:	3,496 GPD

USE - 135'L X 74'W DRIP DISPOSAL AREA

SCHEDULE OF ELEVATIONS

	INV. EL.
TOP OF FOUNDATION	99.50
BUILDING SERVICE	97.60
GREASE TRAP SERVICE	97.60
3,000 GALLON SEPTIC TANK	
GREASE TRAP TOP	97.28
GREASE TRAP - INLET	96.03
GREASE TRAP - OUTLET	95.78
GREASE TRAP BOTTOM TANK	90.28
11,000 GALLON SEPTIC TANK	
SEPTIC TANK TOP	97.40
SEPTIC TANK INLET (BUILDING)	95.76
SEPTIC TANK INLET (GREASE TRAP)	95.75
SEPTIC TANK OUTLET	95.50
BOTTOM TANK	88.09
6,000 GALLON PUMP TANK	
DRIP TANK TOP	97.04
DRIP TANK INLET (FROM PROCESSING TANK)	95.46
DRIP TANK OUTLET (TO HYDRAULIC UNIT)	95.21
ALARM	92.42
PEAK ENABLE	91.82
DRIP ENABLE	91.21
OFF	90.88
BOTTOM TANK	89.71

ESTIMATED SEASONAL HIGH GROUNDWATER EL. 92.3 (TP-1)

BUOYANCY CALCULATIONS

3,000 GALLON GREASE TRAP	
TANK VOLUME (CU. FT.)	735
PORTION OF TANK IN WATER AT SEASONAL HIGH GW (EL.=4.0')	29%
EQUIVALENT WEIGHT OF WATER DISPLACED (LB.)	13,236
SOIL COVER VOLUME (CU. FT.)	84
WEIGHT OF SOIL COVER, (LB.)	12,600
TANK WEIGHT (LB.)	36,900
TOTAL BALLAST (TANK + SOIL) (LB.)	49,400
BALLAST REQUIRED (BUOYANCY FORCE - TOTAL BALLAST) (LB.)	-36,164
CONCRETE BALLAST REQUIRED (CU. FT.)	NONE
BALLAST NOT REQUIRED	
11,000 GALLON SEPTIC TANK	
TANK VOLUME (CU. FT.)	2,336
PORTION OF TANK IN WATER AT SEASONAL HIGH GW (EL.=4.0')	45%
EQUIVALENT WEIGHT OF WATER DISPLACED (LB.)	65,902
SOIL COVER VOLUME (CU. FT.)	201
WEIGHT OF SOIL COVER, (LB.)	30,150
TANK WEIGHT (LB.)	104,000
TOTAL BALLAST (TANK + SOIL) (LB.)	134,150
BALLAST REQUIRED (BUOYANCY FORCE - TOTAL BALLAST) (LB.)	-68,248
CONCRETE BALLAST REQUIRED (CU. FT.)	NONE
BALLAST NOT REQUIRED	
6,000 GALLON SEPTIC TANK	
TANK VOLUME (CU. FT.)	1,346
PORTION OF TANK IN WATER AT SEASONAL HIGH GW (EL.=4.0')	33%
EQUIVALENT WEIGHT OF WATER DISPLACED (LB.)	27,475
SOIL COVER VOLUME (CU. FT.)	249
WEIGHT OF SOIL COVER, (LB.)	37,350
TANK WEIGHT (LB.)	63,000
TOTAL BALLAST (TANK + SOIL) (LB.)	100,350
BALLAST REQUIRED (BUOYANCY FORCE - TOTAL BALLAST) (LB.)	-72,875
CONCRETE BALLAST REQUIRED (CU. FT.)	NONE
BALLAST NOT REQUIRED	

WASTEWATER DESIGN FLOW CALCULATION

DESCRIPTION	NUMBER	UNITS	TYPE OF ESTABLISHMENT	FLOW RATE (GPD)	DESIGN FLOW (GPD)	KITCHEN WASTE (GAL)
FUNCTION HALL	200	SEATS	FUNCTION HALL	15	3,000	
FOR GREASE TRAP SIZING	200	SEATS	RESTAURANT, KITCHEN FLOW	15		3,000

GRAPHIC SCALE
30 0 10 20 40 80
(1 IN = 69 FEET)

last modified: 06/24/10 printed: 06/24/10 by:jh H:\Projects\2008\8123 Taunton River WS PH I\8123-Drawings\Lakeville\dwg\8123-LAKEVILLE-WW.dwg

Revisions
1 06/24/10 AB Revisions Per

Horsley Witten Group, Inc.
Sustainable Environmental Solutions
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Sandwich, MA 02563
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Plan Set: TAUNTON RIVER WATERSHED PLAN
LAKEVILLE COMMISSARY BUILDING
75% DESIGN PLANS
Plan Title: WASTEWATER SITE PLAN

Prepared For:
Town of Lakeville
346 Bedford Street
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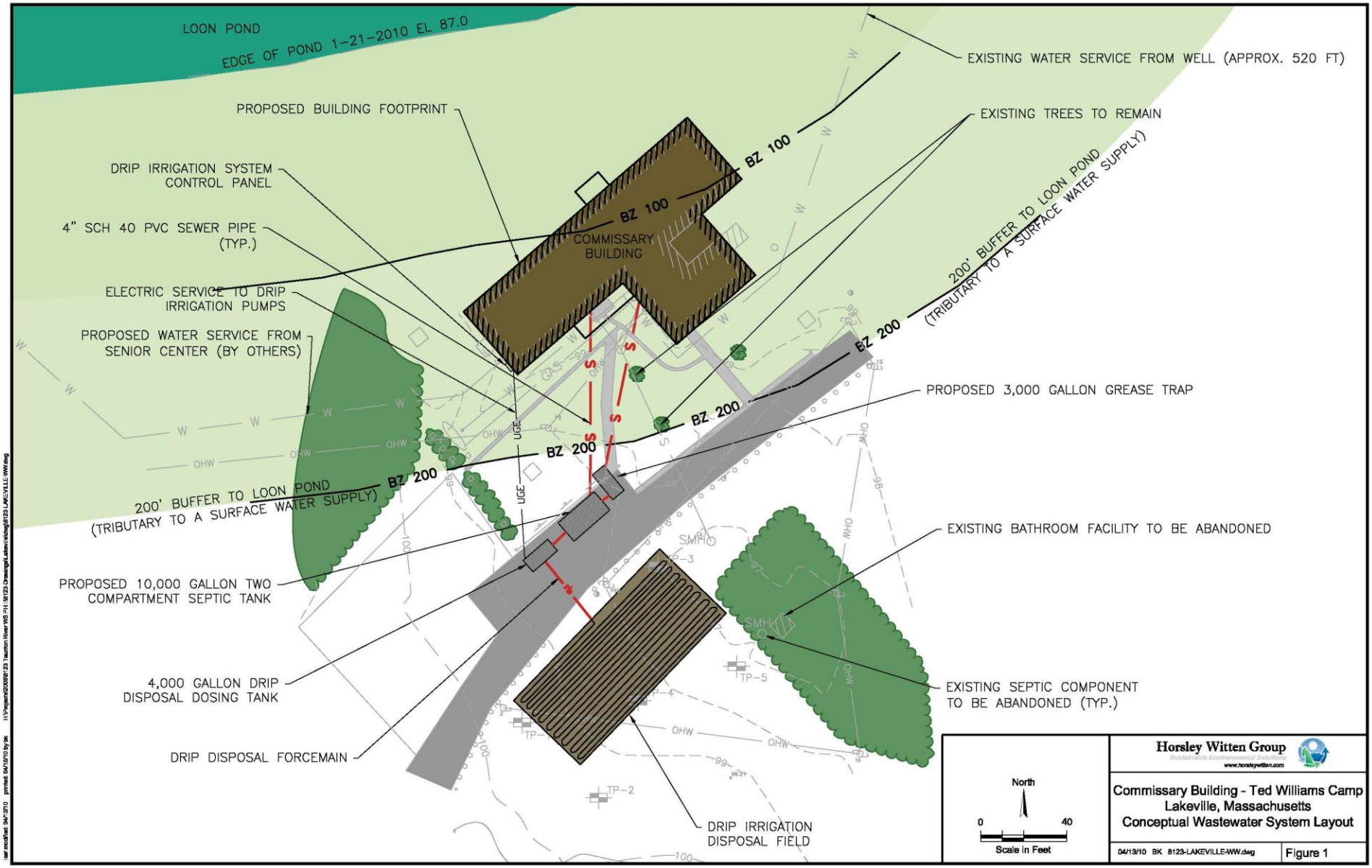
Phone: (508) 946-8800
Fax: (508) 946-8813

Survey Provided By:
Horsley Witten Group, Inc.
90 Route 6A
Sandwich, MA 02563
Phone: 508-833-6600
Fax: (508) 833-3150
Date: May 4 & 11, 2010

Registration:

Project Number: 8123
Sheet: 4 of 5
Drawing Number: C- 4

Figure 4.6. Rendering of Proposed On-Site Wastewater Treatment and Drip Irrigation Disposal System at Ted Williams Park Commissary Building, Lakeville



5.0 LID DRIVEWAY RETROFIT AT OCEAN SPRAY PROCESSING FACILITY, MIDDLEBOROUGH

5.1 Overview

Ocean Spray Cranberries was selected as a potential demonstration project partner primarily due to the location of the Middleboro processing plant adjacent to the Nemasket River and within priority habitat as identified by The Nature Conservancy (TNC). The Steering Committee was also interested in the participation of a corporate partner as a means of reaching out to the business sector through this project. Working primarily with the Corporate Sustainability Officer at the Ocean Spray Cranberries headquarters on the Lakeville/Middleboro line, HW with support from TNC was successful in attracting Ocean Spray's active support and participation in the project. Along with participation in the demonstration design, Ocean Spray Cranberries also hosted a public educational meeting at their headquarters in October 2010. At this meeting, HW presented several of the demonstration and code reform projects, with particular focus on the Ocean Spray project and the Lakeville code reform recommendations develop during Phase II of the Taunton River Watershed Management Plan.

5.2 Data Collection and Design Process

HW and representatives from TNC (project Steering Committee members) met with the Ocean Spray Sustainability Officer and Environmental Health and Safety Manager in the early fall of 2009 to discuss the potential of doing a demonstration project at one of their facilities. Following Ocean Spray's Board of Directors' agreement to participate in a demonstration project as part of their corporate sustainability efforts, HW and TNC followed up with more detailed site visits to the Middleboro processing plant in late October and early November 2009. We identified opportunities for projects relating to reuse of roof runoff for cooling water and LID stormwater controls on the grounds. HW then prepared a memorandum for Ocean Spray describing a range of retrofit opportunities that would be feasible within the scope and budget of this project (see Figure 4.7 below); Ocean Spray also selected two adjacent projects that addressed stormwater runoff from the entrance drive to the plant. HW completed a 75% design for a sediment forebay and bioswale along the main entrance drive into the Ocean Spray manufacturing site. Ocean Spray has indicated their interest in moving towards constructing this bioswale and continue to discuss this internally.

5.3 Description of Design

HW completed a 75% design for a sediment forebay and bioswale along the main entrance drive into the Ocean Spray manufacturing site. This will provide improved water quality treatment, detention, and modest infiltration for the stormwater draining from the driveway and a portion of the loading area near the main building. In developing this design, HW performed a site survey and visited the site twice to meet with the Plant Manager. A site plan and rendering are presented in Figures 4.8 and 4.9 below. A full plan set for the 75% engineering design, along with a planning level cost estimate and operation and maintenance information is provided in the Appendices.

The manufacturing facility is located adjacent to the Nemasket River within the Taunton River Watershed. The site is located adjacent to priority riparian habitat as identified by the TNC. According to the Taunton River Watershed Water Balance Model, the Taunton River Watershed as a whole experiences a deficit of 6.2% of groundwater and stream base flow compared to natural pre-developed conditions, and the Nemasket River watershed (one of eight resource subwatersheds that make up the Taunton Watershed) experiences a deficit of 2.8%. However, when surface water withdrawals and surface water discharges are accounted for in addition to direct groundwater impacts, the model indicates that the Nemasket River watershed experiences a 40.5% deficit, due to significant surface water supply withdrawals. Within the Nemasket River watershed, there are nine smaller subwatersheds. The Ocean Spray facility is located within a subwatershed that is currently in balance with natural conditions.

The proposed project will help to protect that balance, on a very localized scale, and will provide improved infiltration and water quality treatment for runoff from the facility's well-traveled driveway. Under current conditions, very little infiltration of precipitation occurs before runoff discharges directly into the riparian wetland system of the Nemasket River with little to no pretreatment or peak flow controls to reduce erosion. Under the proposed design, peak flows will be managed so that the discharge into the wetland system will not cause erosion. These improvements will help to maintain a more natural hydrologic regime at the site level and within the adjacent riparian wetlands, and will help to ensure that fewer pollutants are reaching the adjacent wetland system and priority habitat.

The drainage area contributing to the proposed forebay and bioswale is 2.6 acres, including 1.9 acres of impervious area. The design is sized to treat the first 0.5 inch of runoff from each rain event to remove pollutants and infiltrate an estimated 20% of annual recharge.

Existing Conditions: Ocean Spray Cranberries Processing Facility in Middleboro

Figure 4.7. Retrofit Opportunities at Ocean Spray Cranberries Processing Facility, Middleborough, MA

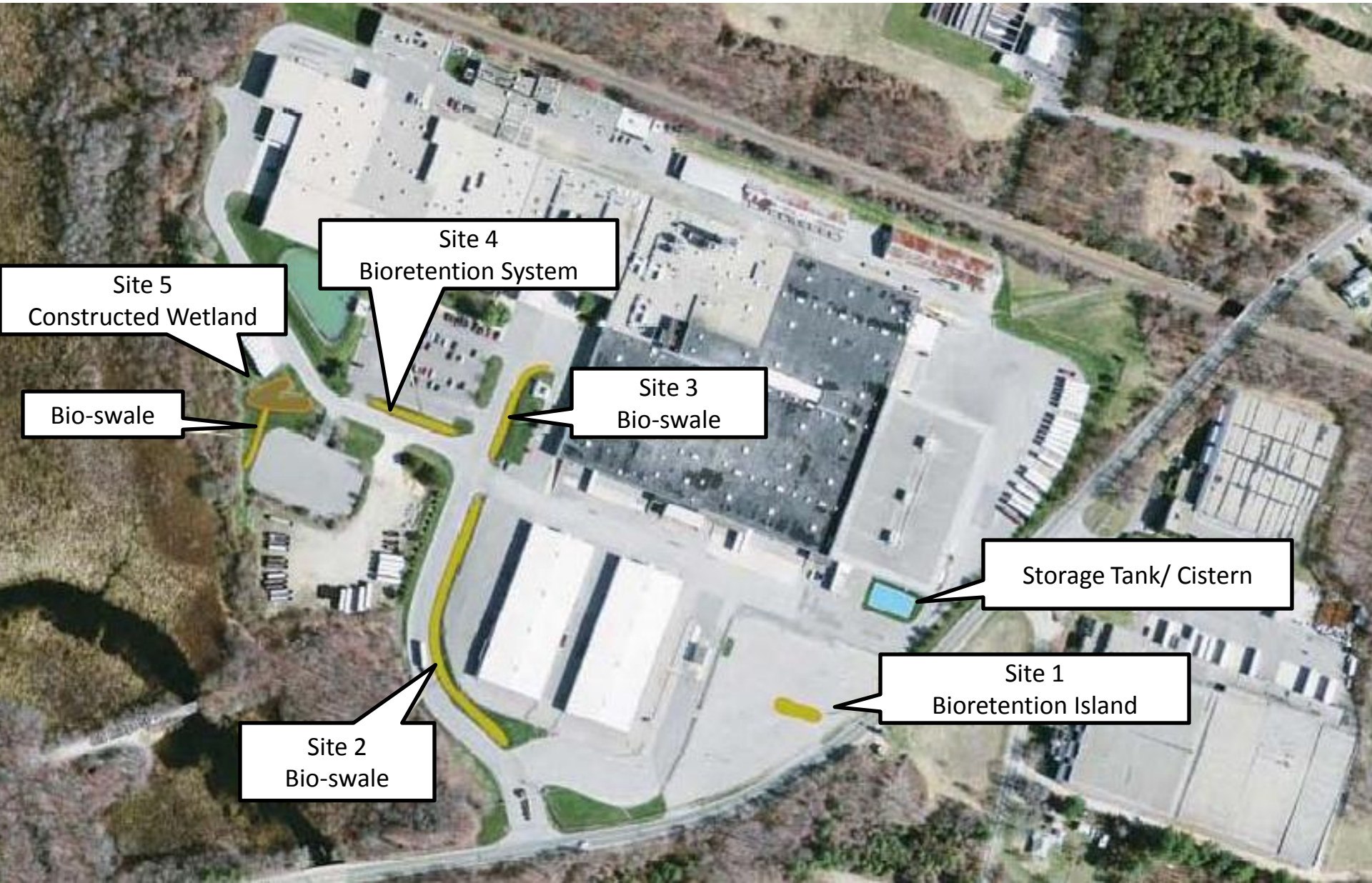


Figure 4.8. 75% Design Plan for LID Retrofit of Entranceway at Ocean Spray Facility in Middleboro

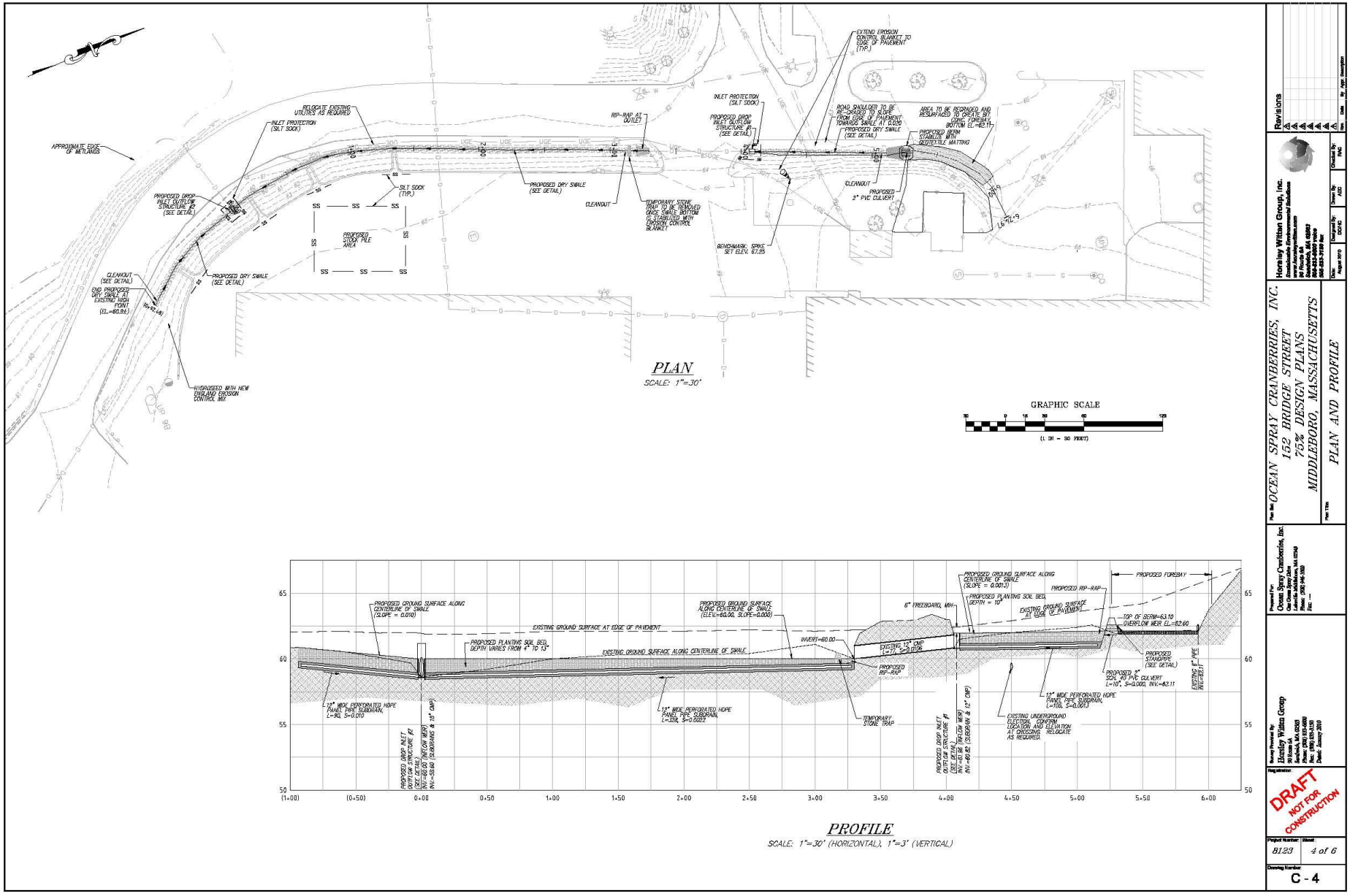
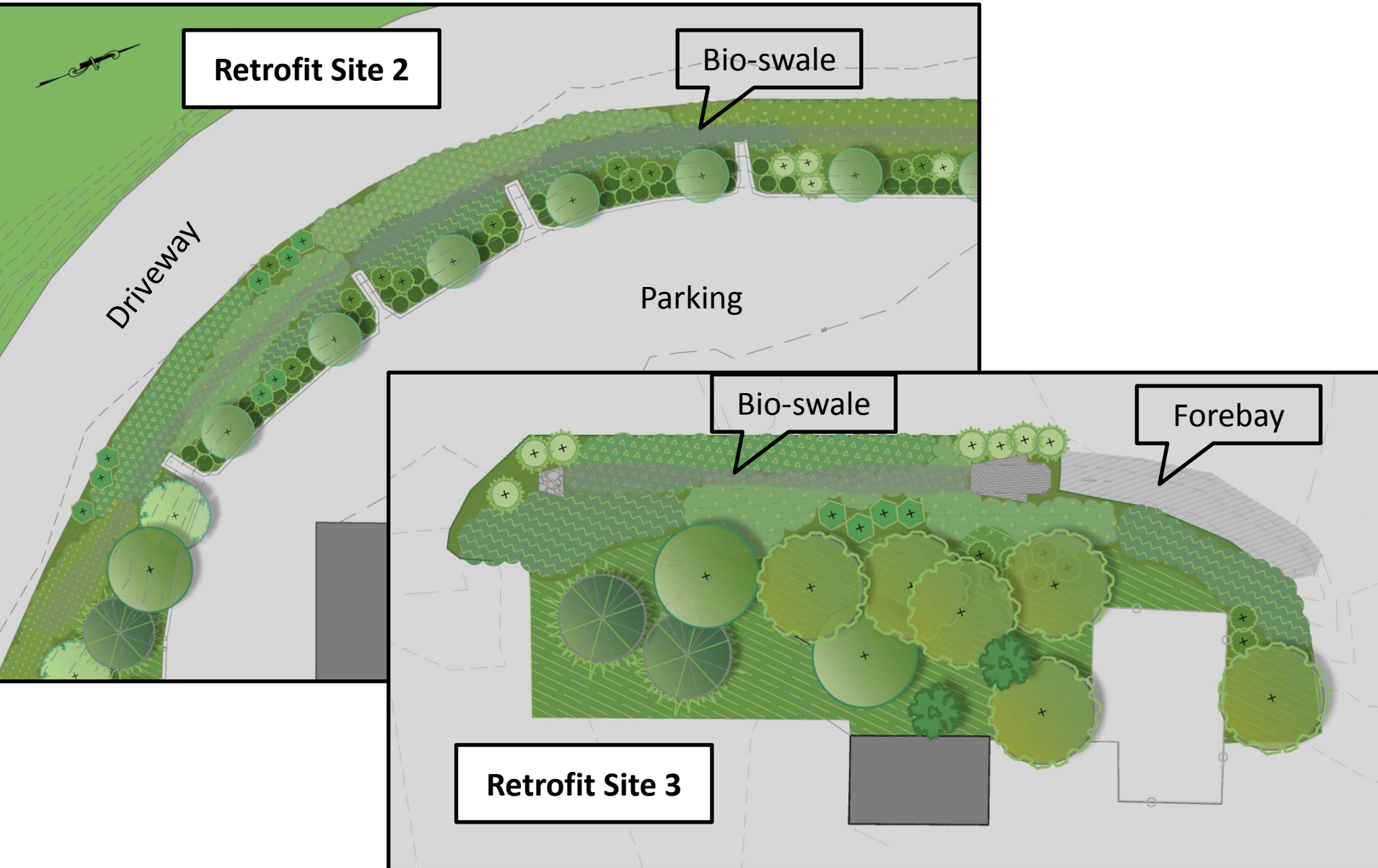


Figure 4.9. Rendering of Proposed LID Retrofit of Entranceway at Ocean Spray Facility in Middleboro



6.0 LID DRIVEWAY RETROFIT AND TEACHING TOOL AT BRISTOL COUNTY AGRICULTURAL HIGH SCHOOL, DIGHTON

6.1 Overview

Bristol County Agricultural High School was recommended by several Steering Committee members as a potential demonstration location due to the proximity of the school to the adjacent Taunton River mainstem, as well as the educational opportunities and visibility of a project located at the school. The site is also located within an impacted subwatershed with a water balance deficit, as indicated in Table 4.1 above, and it was known that the school was working toward connecting to the Dighton centralized sewer to address its wastewater treatment and disposal needs, a move that could be partially offset, at least in principle, by a comprehensive LID retrofit of the school campus. The Steering Committee agreed to support an LID demonstration project at the school to promote keeping water local and provide a valuable educational opportunity. HW designed two swale and bioretention systems to capture runoff from a highly active and visible location along the exit driveway from the main campus area, including the agricultural machine and mechanic shop. The sites selected were experiencing erosion due to lack of drainage infrastructure in one case, and a failing catch basin system in another case.

6.2 Data Collection and Design Process

HW had an initial site visit with the School Superintendent, Krista Paynton, along with approximately 20 students and several teachers in the environmental and horticultural courses. We toured the full campus to identify potential sites for LID improvements, and used the experience and opportunity to teach the students about the project. With help from the students, we identified a range of potential retrofit sites (see Figure 4.10) and prepared a memorandum outlining these options for the school's consideration. The final sites were selected by the school and HW proceeded with the field work and design. HW performed a topographical survey of the entire project area, as well as test pits and infiltration testing using an infiltrometer to determine soil type, depth to groundwater and infiltration rate in preparation for the design. The school provided the services of a backhoe and operator to perform the test pits. The final 75% designs, including a planting plan of native non-invasive vegetation, were provided to the school for final review and the Superintendent indicated that the school was pleased with the design and intended to construct them when possible.

The school was awarded State Revolving Funds (SRF) in 2010 to connect to the Dighton sewer system, and we understand that this money can also be used to fund these stormwater improvements. These projects, the sewer connection and the LID retrofit, are linked in the application such that the LID retrofit, at least in concept and as a demonstration project, would provide an example of how runoff could be infiltrated and water quality could be improved as an offset against the conveyance of wastewater off-site, an obvious loss of water to the local water balance. HW did not participate in the SRF funding application or review process, or perform any detailed analysis of the exact tradeoffs in the water balance between the sewer and stormwater projects. Rather, the on-site stormwater demonstration project is meant as an

example that could be replicated across the site to help mitigate the water balance losses from the sewer project, in addition to providing a valuable educational opportunity at the school.

The school also intends to have the students participate in the construction of the bioretention facilities in some way, and certainly in the ongoing monitoring of the health of the vegetation in the systems to ensure that the systems continue to function. The school also intends to incorporate education about vegetated LID practices into the curriculum, including hands on teaching about plants suitable for vegetated LID practices. The school is also looking into alternative funding sources to bring this project to 100% design and construction if the timing does not coincide with the sewer project.

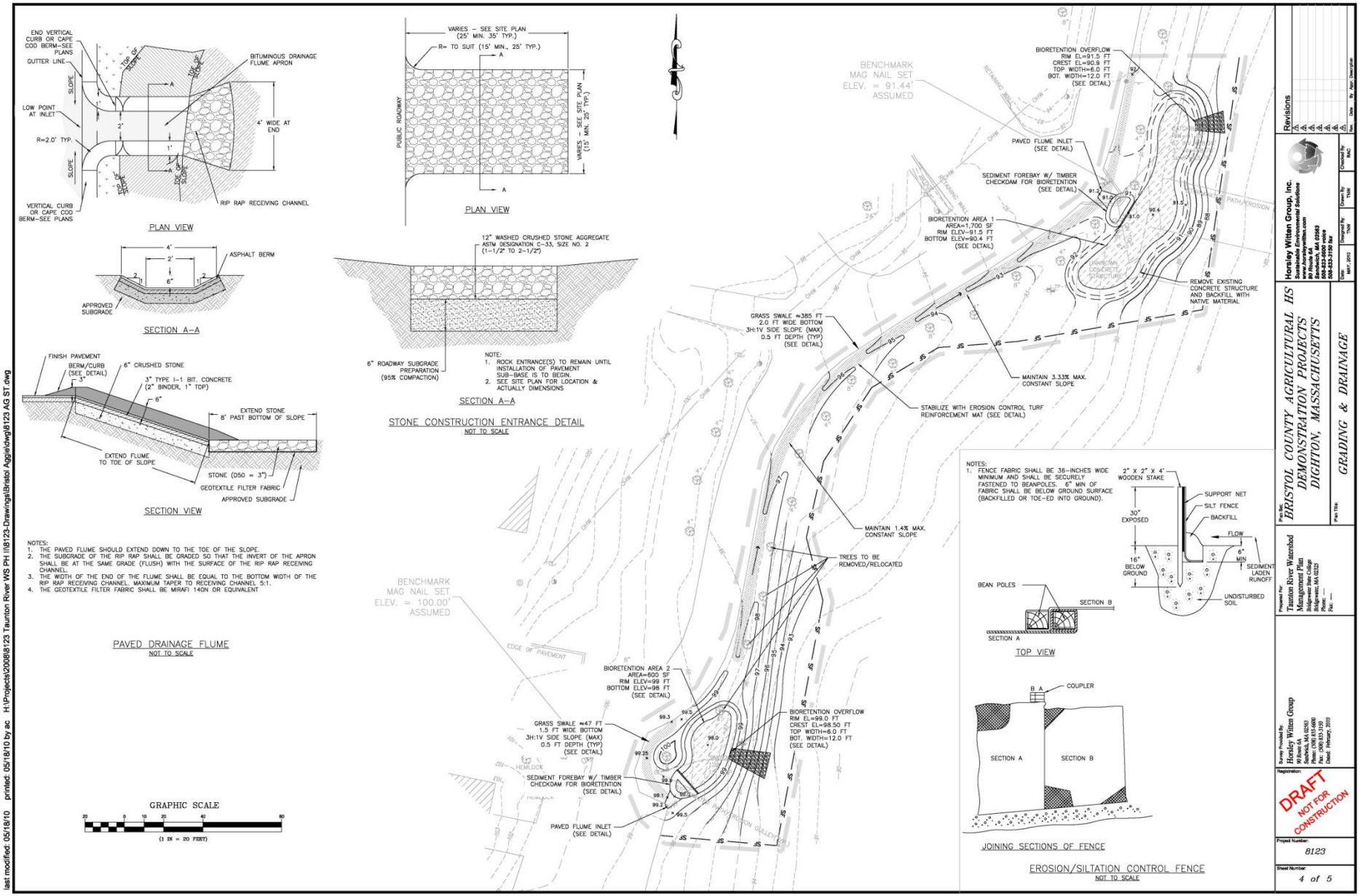
6.3 Description of Design

HW has designed LID stormwater management systems to address two problem areas at the school's main parking lot. The designs consist of capturing flow from the parking lot in a small swale that leads to a bioretention system before discharging toward the agricultural fields below the parking lot. The Taunton River is located at the opposite side of the agricultural fields downstream of the parking lot. The new design will provide improved water quality treatment, detention, infiltration, and will reduce erosion at the edge of pavement. The 75% design plans are presented in Figure 4.11 below. A full set of the engineering design plans is presented in the Appendices, along with a planning level construction cost estimate.

Existing Conditions: Bristol County Agricultural High School, Dighton

Figure 4.10. Retrofit Opportunities at Bristol County Agricultural High School, Dighton

Figure 4.11. 75% Design Plans for the LID Retrofit at Bristol County Agricultural High School, Dighton



7.0 LID PARKING LOT RETROFIT AT BELMONT STREET SOCCER FIELDS, EAST BRIDGEWATER

7.1 Overview

The Belmont Street Soccer Fields site in East Bridgewater was brought to our attention by a member of the public who attended several of our public meetings and was aware of our search for demonstration projects and willing partners. The existing soccer field facility, currently owned by the town, was a former farm site adjacent to a wetland resource system. The parking area had been designed and permitted several years earlier, but had not been completely constructed, and therefore was left at an interim stage with a gravel base and informal parking and traffic patterns. The town's previous design did not include drainage infrastructure or stormwater management practices, and therefore, even if built out to full design, would not exhibit the goals of the Taunton Watershed project to keep water local, restore the natural water balance and improve and protect habitat areas. HW provided a design to retrofit the existing parking lot using bioretention and constructed wetland systems that detain and treat the stormwater runoff from the parking lot prior to discharge into the adjacent wetland system, and also better blend with the natural habitat surrounding the parking area. The town and the East Bridgewater Youth Soccer Association are both interested in completing the formal parking lot at the site in the future, but neither organization currently has the necessary funds available for this work.

7.2 Data Collection and Design Process

HW developed a 75% design using LID techniques to address stormwater runoff from the parking lot at the Belmont Street soccer fields in East Bridgewater. The current parking lot is loosely graded and traffic flow is informal with no lined parking spaces. The proposed design includes a reduction in pavement from the original design, a reconfiguration of parking and traffic flow, and the implementation of LID techniques including swales and constructed wetlands to capture and treat stormwater runoff. The previous design and current installation did not include any stormwater management infrastructure. This will help to maintain the habitat benefits provided by the adjacent wetlands by blending the site with its surroundings, providing improved water quality treatment, and reducing the peak flows into the wetland systems.

In developing this design, we delineated the wetland resource areas and performed a topographic survey of the property. HW worked with members of the Board of Selectmen as well as a representative of the Youth Soccer League to review previous plans and confirm our work as we progressed.

7.3 Description of Design

The 65.3 acre property is owned by the Town of East Bridgewater and is mainly undeveloped, excluding the northern portion of the site which is used as one of the Town's youth soccer facilities. Access to the soccer facility is provided by a gravel loop road which connects to Belmont Street. It is our understanding that the gravel parking area and road that are currently being used have never been fully constructed as originally planned, due to limited finances.

Therefore, the current parking and traffic flow is informal with no lined parking spaces. The original plan was designed to provide 276 spaces, but had no associated stormwater management and treatment infrastructure. Of those 276 planned spaces, only approximately half to two thirds are actually provided informally on the current site. A large stockpile of material is located in the northeast portion of the site and a pile of reclaimed asphalt is located at the end of the gravel parking in the north central portion of the site. A small building is used as a snack bar and equipment storage. Wastewater from the snack bar is treated in a new septic system that was installed in September of 2006. The site has six soccer fields which are irrigated by on-site water wells. Water service from Belmont Street provides water to the snack bar. The Salisbury Plain River runs from west to east through the southern portion of the site, and Beaver Brook runs along the eastern portion of the site from north to south. An unnamed Brook also runs through the western portion of the site from north to south. Two large wetlands are in close proximity to the existing soccer facility, one in the northwest portion of the site and the other in the north central portion.

The proposed design is intended to reduce the impervious surface associated with the roadway and parking lot by approximately 30% from what was originally designed by using LID stormwater management techniques including grassed swales and constructed wetlands. A site plan is presented in Figures 4.12 below. A full plan set for the 75% engineering design and a planning level construction cost estimate are provided in the Appendices.

Constructed wetlands provide enhanced pollutant removal efficiencies when compared to traditional stormwater practices, and have been designed to provide significant reductions in peak flows of runoff from the parking area and driveway. In addition, under the January 2008 revisions to the MA Wetlands Protection Regulations (310 CMR 10.00), the constructed wetlands will not be considered jurisdictional wetland resource areas and will not have any protected buffer associated with them. They can (and must) be maintained for the purposes of stormwater management.

Existing gravel parking areas will be regraded and parking bumpers will be installed to delineate the proposed 192 parking spaces, including three (3) handicapped spaces and one van accessible handicapped space. (Please note that two previously planned playing fields on the northern side of the site were determined to be unlikely to be constructed based upon our wetland delineation that showed the wetland area very close to the northern driveway. Therefore, we anticipated that fewer parking spaces would be needed or permissible in that area.) A gravel sidewalk from the eastern parking lot to the snack area is also proposed. All areas outside the new roadway and parking layout will be loamed and seeded. All remaining gravel will be removed and replaced with loam and seed.

Parking lot and roadway runoff will be directed to grass drainage channels for conveyance and pretreatment. Grassed drainage channels accent the natural landscape, break up impervious areas, and are appropriate alternatives to curb and gutter systems. They are best suited to treat runoff from lower density areas and roadways and provide limited infiltration to groundwater.

Stormwater will be conveyed from the grass channels to sediment forebays and then to constructed wetland areas. Constructed wetlands are excavated basins with irregular perimeters

and undulating bottom contours into which wetland vegetation is purposely placed to enhance pollutant removal from stormwater runoff. Constructed wetland systems are designed to maximize the removal of pollutants from stormwater runoff via several mechanisms: microbial breakdown of pollutants, plant uptake, retention, settling, and adsorption. The six constructed wetland areas proposed are designed to treat the first half inch of stormwater runoff, also known as the water quality volume under the MA Stormwater Standards.

Existing Conditions: Belmont Street Soccer Fields, East Bridgewater

Figure 4.12. 75% Design Plan for LID Parking Lot Design at Belmont Street Soccer Fields, East Bridgewater